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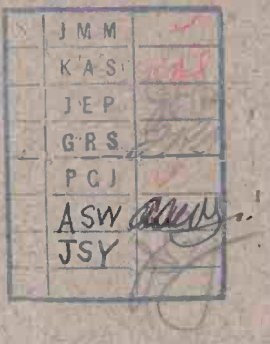
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

FOREST INSECT INVESTIGATIONS

DAMAGE TO ORNAMENTAL SPRUCE - BLUE & NORWAY BY THE SPRUCE NEEDLE MINER -- TANIVA ALBOLINEANA KEARFOOT IN THE VICINITY OF COEUR D'ALENE, IDAHO



By
H. J. Rust
Sr. Scientific Aide

Forest Insect Laboratory
Coeur d'Alene, Idaho
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DAMAGE TO ORNAMENTAL SPRUCE - BLUE & NORWAY
BY THE SPRUCE NEEDLE MINER -- TANIVA
ALBOLINEANA KEARFOOT IN THE VICINITY
OF COEUR D'ALENE, IDAHO

History

Prior to the creation of the genus Taniva in 1926* the spruce needle miner was known under the following synonyms: Lepoptychae albolineana Kearfoot, Argyroploce abietana Fernald, Olethreutes picese Busck, Hemimene albolineana B & McD, Argyroploce piceae B & McD, and Olethreutes abietana Forbes.

The known distribution in 1926 was North Carolina, New York, Mass., Maine, Minn., Mich., Iowa, Colorado, British Columbia, Alberta, Manitoba, Ontario.

Food Plants Picea and Abies

The first record received at the Forest Insect Laboratory, Coeur d'Alene, Idaho of the presence of this insect in Idaho was on June 15, 1933. Moths reared from infested Engelmann spruce collected at Hailey, Idaho were identified by Mr. C. Heinrich as Taniva albolineana Kearfoot.

In April 1934 the spruce needle miner was reported as destructive to ornamental blue spruce in Coeur d'Alene, Idaho. An examination at that time gave evidence of the insect being present for several succeeding years judging from the amount of old webs present on the infested spruce. The center of the infestation in 1934, however, appeared to be confined to a small area, as but very few ornamental spruce planted

* Revision of the North American Moths of the Subfamilies Laspeyresiinae and Olethreutinae 1926. By C. Heinrich. U.S. Nat. Museum Bulletin # 132.

in the city showed evidence of attack. The following year it was noted as spreading, and by 1936 practically all the ornamental spruce both blue and Norway within the city limits contained varying degrees of infestation by this insect.

Portion of Tree Attacked

Both the blue and Norway spruce used as ornamental trees have a tendency to continue their crown to the ground level. In time the lower foliage from the ground up to six feet becomes quite dense and matted. In this section of the crown the heaviest infestation by the spruce needle miner occurs. From the lower section of the tree the infestation decreases gradually, dying out toward the top in large trees. Small trees are infested more evenly over the entire crown.

Amount of Defoliation Caused by the Feeding Activities of the Larvae

The spacing of webs on an infested tree may be somewhat determined by the gravid female moths. A large number of webs examined showed what could be considered as the egg laying potential for one moth, at least for the start of each web. Whether more than one web can be attributed to each female moth is not known. The webs were found to contain from 4 to 20 larvae with an average of 7, and an average of 10 needles destroyed by each larvae during the complete feeding period. The completed outer webs vary in length from 1 1/2 to 3 inches, the larger webs often being extended beyond the limits of the cut and confined needles that had been used for food. After

the second year of attack the abandoned webs begin to show the trend of the infestation and the necessity for control if such is contemplated. After continued feeding from several years' attacks, many of the lower limbs are completely confined in webs and die from the results of defoliation.

OBSERVATIONS ON SEASONAL HISTORY

Emergence: In 1934 the start of emergence was recorded on May 14th, in 1935 on May 27th, and in 1936 on May 22nd. These records would indicate that the period from the middle to the last of the month of May could be considered as the usual time for the first appearance of the moths. The main emergence period lasts from a week to ten days, with desultory emergence lasting from 30 to 40 days.

Oviposition: In 1934 no eggs could be located on infested trees. In 1935 three groups of eggs were secured from moths confined in rearing jars. One group contained 6 eggs, one 7, and one 17 respectively. The eggs are pale green in color and are laid in groups in shingle fashion on the wider portion of the needle. The group may start from either the top or bottom of the needle, as both directions were recorded. In 1936 two needles were secured on which eggs had been deposited. These were collected from a small blue spruce growing in the insectary yard. This spruce was heavily attacked in 1935 and was covered with a cheese cloth bag before emergence started in 1936. One group contained 7 eggs the other 19 eggs. The group of 17 secured in 1935 and the one of 19 eggs in 1936 apparently were not deposited in continuous succession, as

irregular laps were noted, indicating either a slight change in position or two or more different egg-laying periods. From six to seven eggs appear to constitute a complete group. From 10 to 12 days are required for the eggs to hatch, depending somewhat on developmental air temperatures.

Larva: Shortly after hatching the larvae cut an opening near the base of a green needle, and as soon as the interior is reached feeding begins. The larvae are gregarious feeders during their early stages of development and partly up to the time of hibernation, more so in the blue spruce owing to the larger size of the needles as compared with Norway spruce. Freshly attacked needles were found to contain two larvae with one-fourth inch of the interior eaten and four larvae with one-half inch. Completely eaten out needles were found to contain as many as eight larvae, but this number was unusual. As the larvae increase in size, the tendency to separate becomes more apparent. An examination of a large number of infested needles showed 52% contained but one larva during early June as compared with 96% with one larva by the first of August. These records are for blue spruce. Norway spruce gave a slightly higher percentage for single larva. As soon as the contents of the needle has been consumed by feeding, the needle is detached at the base and confined in a web, the needle lying parallel with the leaf stem. Shortly after starting to feed on a green needle, the larvae construct a funnel-shaped web reaching from the entrance hole in the needle to the main stem. This web affords protection to the feeding

larvae at first, and later is a means of communication with the larger web covering the discarded needles. All frass is exuded through the entrance hole in the needle and accumulates in the large web along the stem. This frass or excrement later is utilized for an outer covering for many of the cocoons preparatory to pupation. Some external feeding is done by the larvae just prior to the prepupal stage while they are confined in the large web surrounding the stem, but no entire needles were found eaten out at this time. Feeding continues from the time the larvae hatch until the heavy frosts appear, usually late in October, at which time the larvae average 5.2 mm in length. They then prepare for hibernation, each one selecting a hollow or eaten-out needle still attached to the leaf stem. The larva are extended to their full length in the needle with the head toward and near the entrance hole at the base of the needle. A short web is constructed which reaches from the entrance hole to a short distance beyond the head of the larva. It would appear as if this web was constructed more for protection from enemies than from the cold, as but a small portion of the larva is covered. Feeding is resumed at the beginning of moderate temperatures during the latter part of March and continues up to the prepupal period near the middle of April. The average number of needles destroyed by each larva in blue spruce was found to be 10.

Pupation: In 1934 the start of the pupation period began on April 11th, in 1935 on April 17th, and in 1936 on April 10th. At the beginning of the pupation period the larvae leave the needles in

which they have been feeding and congregate in the large outer web constructed along the main stem. Each larva then constructs a silken cocoon. Many of these are covered on the outside with the excrement exuded from the needles during the feeding period. After passing through the prepupal stage a chrysalid is formed from which the moth emerges. The average length of the pupation period for the years 1934, 35, and 36 was 35 days. Pupation apparently is not spontaneous, for all the larvae confined in a web, as a few prepupal larvae and pupae can be found in webs long after the main emergence is complete, some being noted as late as the first week in July.

CONTROL METHODS

Spraying: Spraying experiments were conducted during July 1934 on infested spruce at the Coeur d'Alene Indect Laboratory. Two treatments were used, one consisting of a two percent oil emulsion spray with a small amount of nicotine sulphate added, and the other commercial carbon bisulphide. The results of the oil spray were very unsatisfactory, the percentage of kill varying from 10 to 25 percent, with slight burning of the foliage. The small percent of larvae killed was apparently due to the lack of penetration of the oil through the outer web and into the infested needles. The carbon bisulphide was injected into the webs from a long-spouted oil can. This method resulted in a 98 percent kill of the larvae and no apparent damage to the green foliage. Neither of these two methods would be practical for large trees.

Washing out webs with a Strong Stream of Water

This method consists of forcing a strong stream of water through a small aperture nozzle attached to a garden hose and washing the webs loose. Excellent results are obtained when the washing is carefully done. With large trees the hose can be carried up by means of a tall ladder carefully placed against the infested spruce. All hosing operations should start as high as infestation is found on the tree, and the webs washed down through the foliage as the work progresses. In the more heavily infested portions close to the ground all matted limbs should be separated while washing out the webs. At the completion of the hosing process all webs and loose needles lying around the base of the tree and beyond the edge of the lower crown should be immediately removed and burned to prevent the larvae in the webs and needles from returning to the tree. The most opportune time for washing out the webs is from the middle of March to the middle of April just before the leaf buds start swelling. Hosing during the opening of the leaf buds and before the new growth is mature has a serious effect on the new foliage. Infested trees can again be successfully washed during the period September 1st to October 15th or up to the beginning of cold weather. At this time the webs are smaller and require more care in hosing than during the spring.

Respectfully submitted,

H J Rust

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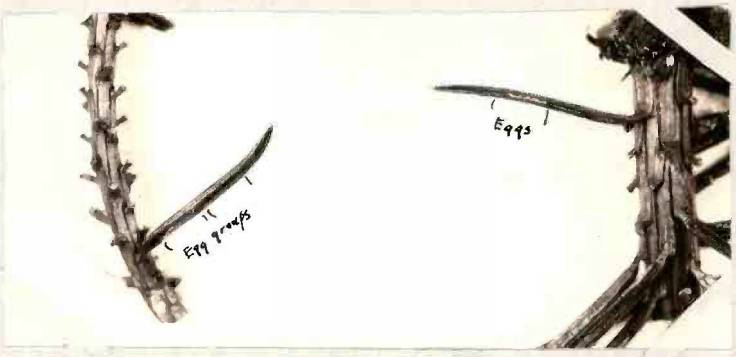
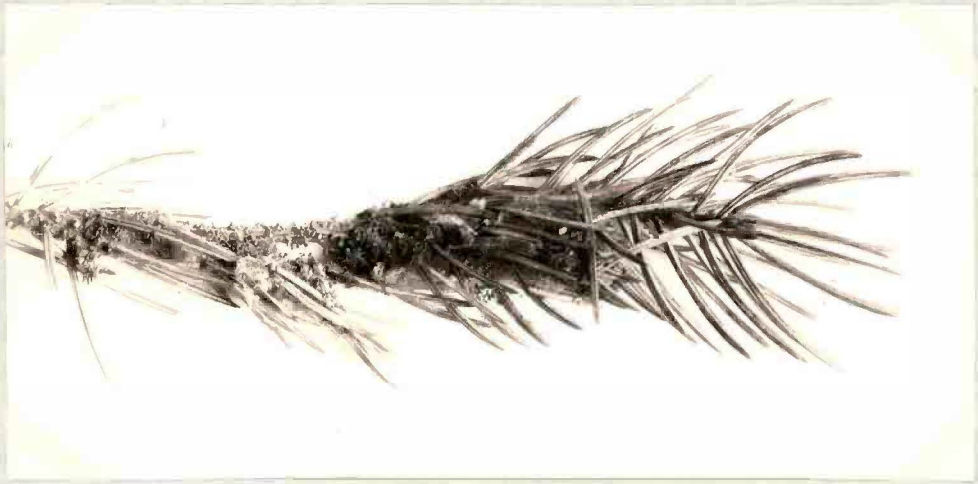


Groups of eggs of the spruce needleminer deposited on blue spruce needles.

Life History of the Spruce Needleminer

1. Larvae, half grown to mature
2. Chrysalids containing pupae
3. Single and groups of cocoons containing prepupal larvae and pupae
4. Empty chrysalids, protruding from cocoons
5. Male and female moths, near life size

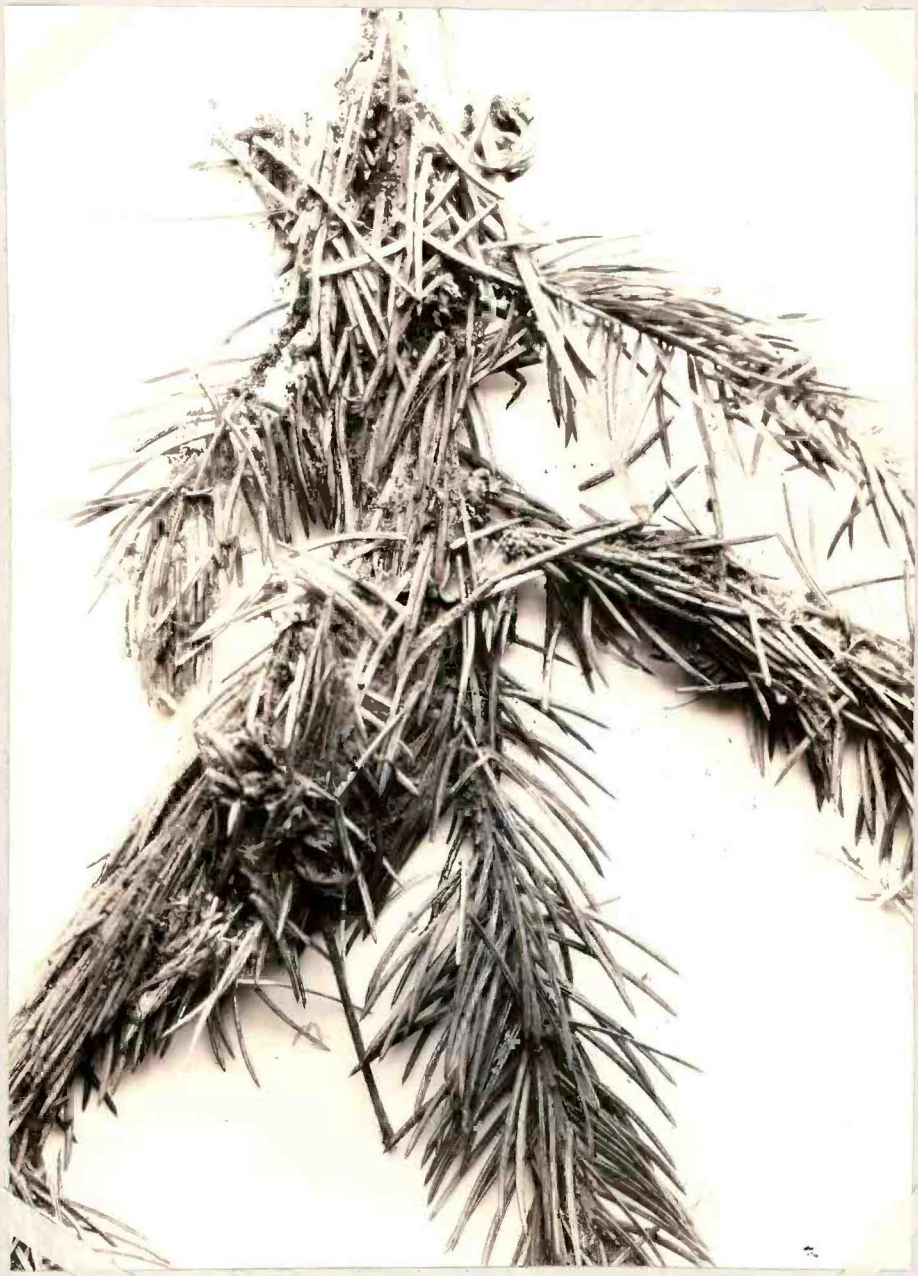
A group of spruce needles showing entrance holes made by spruce needleminer larvae, also webs constructed from entrance hole to larger web on main stem. Infested needles are occasionally found with the entrance hole in the middle and also near the tip. The most common attack is at the base of the needle.



Twig from blue spruce with outer web removed showing a cluster of spruce needleminer cocoons prior to emergence.

Twig from blue spruce showing two webs constructed by the spruce needleminer and detached needles confined in the web.

A large web in blue spruce containing 20 spruce needleminer larvae. Considerable pressure is necessary to destroy a web of this type by the hosing process.



Twig from blue spruce showing the results of three seasons' attacks by the spruce needleminer.

Ornamental Norway spruce growing in the Coeur d'Alene, Idaho city park. These spruce became heavily infested by the spruce needle-miner in 1935. Two treatments of the hosing method and the removal of a great amount of the matted crown near the ground reduced the infestation approximately 95% in one season.

Typical growth of ornamental blue spruce. This tree was heavily infested in 1936 by the spruce needleminer, particularly on the lower crown.

Blue spruce growing in open sunny situation. This spruce failed to form the usual heavy crown reaching to the ground, and while growing but a short distance from the tree shown in Plate VI, was very lightly attacked by the spruce needle-miner.